UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

0737

SEP 13 1989

MEMORANDUM

SUBJECT: Cherokee County - Galena Subsite Action Levels/Levels of Concern

FROM: Glenn Curtis
REMD/SPFD

TO: File

The principle contaminants of concern relative to placement of materials at the ground surface in the Galena subsite [Ground Water Surface Water Operable Unit (GW/SW OU)] have been lead and cadmium. These heavy metals have been found in the subsite soils and surface mine wastes at levels that pose a risk to the public health and environment. Efforts have been underway since the conduct of the Cherokee County Remedial Investigation (RI) to establish action levels/levels of concern for these contaminants found at the subsite. These efforts have been documented in the GW/SW OU Feasibility Study (FS) dated February 26, 1988, (1988 OUFS) and the Agency for Toxic Substances Disease Registry (ATSDR) Health Assessment for the subsite dated February 3, 1989. This memo and supporting documentation provide the basis for EPA to establish the action levels/levels of concern for both lead and cadmium at the Galena subsite.

Since the 1988 OUFS, additional information has become available regarding soil ingestion rates and lead and cadmium cleanup levels. The soil ingestion rates have been revised in a OSWER Directive # 9850.4 (attached) to 0.2 grams per day for children (0 to 6 years of age) and 0.1 grams per day for adults.

The Center for Disease Control (CDC) and subsequently the ATSDR have historically supported an action level for lead in soil between 500 to 1,000 mg/kg (ppm). This action level has been based on studies which revealed blood levels in children increasing above background levels when the concentration in soil or dust exceeds 500 to 1,000 ppm. On a case-by-case basis, the EPA has adopted a lead action level at 1,000 ppm or below for sites in a residential setting. An OSWER Directive (#9355.4-02) dated September 7, 1989, (attached) sets forth a basis for adopting soil cleanup levels for lead in soil.

A level of concern for cadmium in soils has also been established on a case-by-case basis at other Superfund sites. Records of Decision (Smuggler Mountain - Region 8, Celtor Chemical Works - Region 9, Midwest Manufacturing/North Farm - Region 7, Marathon Battery - Region 2, Kin-Buc Landfill - Region 2 - Abstracts attached) at these sites have supported a cadmium action level in soils between 10 and 25 mg/kg (ppm). These levels have been based on unlimited access including residential uses and gardening. Discussions regarding the basis for the Marathon (Health Consultation) and Midwest Manufacturing (Feasibility Study Appendix A - Development of Health-Based Action Levels) cadmium cleanup levels are attached. Subsite-specific assumptions and calculation results which aided the establishment of cadmium cleanup levels for the Galena subsite are attached.

These reference materials supported the Agency in the decision to establish cleanup levels at the Galena subsite. The Record of Decision for the GW/SW OU provide the action levels/levels of concern for lead and cadmium applicable to the Cherokee County site - Galena subsite.

Attachments

Assumptions for Estimating Soil Cadmium Concentrations Cleanup Levels Based on Ingestion of Homegrown Vegetables at the Galena Subsite

1. All values or assumptions are the same as provided in the Midwest Manufacturing - FS Appendix A-2. These include: Average Body Weight; Cadmium Oral Reference Dose; Uptake Factors - Dry to Wet Weight Conversion Factors - and Ingestion Rate Factors for Root, Vine and Leafy Vegetables; Average and Maximum Frequency of Exposure. The following are exceptions or additional assumptions.

2. Vegetable consumption is considered incidental with some subsistence consumption.

3. Maximum cadmium concentration equals 79 mg/kg.

Calculation Results (15 day/30 day exposure)

	Cadmium Cleanup Level
3 vegetable types	3.2/1.6
2 vegetable types	37.0/18
1 vegetable type	100.0/50

REFERENCES

Mellard, David N., Sept. 1988, "Health Consultation: Soil Cadmium Levels in Vegetable Gardens Associated with adverse Human Health Effects, Marathon Battery Site, Putnam County, New York."

U.S. EPA, Sept. 1989, "Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites", OSWER Directive #9355.4-02.

U.S. EPA, Jan. 1989, "Interim Final Guidance on Soil Ingestion Dates", OSWER Directive #9850.4

U.S. EPA, Sept. 1988, "Feasibility Study Report for Midwest Manufacturing/North Farm Site North Farm Operable Unit, Kellogg, Iowa."

U.S. EPA, Feb. 1988, "Groundwater and Surface Water Operable Unit Feasibility Study, Galena subsite, Cherokee County site, Kansas."

U.S. EPA, Sept. 1986, Record of Decision - #R08-86/005, Smuggler Mountain, Aspen Colorado

U.S. EPA, Sept. 1985, Record of Decision - #R09-85/009, Celtor Chemical Works, Hoopa Valley Indian Reserve.

U.S. EPA, Sept. 1988, Record of Decision - #R02-88/064, Marathon Battery Site, Cold Spring, New York.

U.S. EPA, Sept. 1988, Record of Decision - #R02-88/068, KM-Buc Landfill, Edison New Jersey

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SUPERFUND PROGRAM
MANAGEMENT BRANCH

JAN 27 1989

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

OSWER Directive 9850.4

MEMORANDUM

SUBJECT: Interim Final Guidance for Soil Ingestion Rates

FROM: J. Winston Porter
Assistant Administrator

TO: Regional Administrators
Regions I-X

Executive Summary:

Risk assessments are conducted at Superfund sites as part of Remedial Investigations required by the Proposed National Contingency Plan, and may be conducted at RCRA facilities undergoing corrective action as described in the soon-to-be Proposed RCRA Corrective Action Rule, to estimate the risk from exposure to substances. Within the risk assessment, an exposure assessment is performed which is based on various exposure assumptions such as soil ingestion rates. This interim final guidance provides recommended soil ingestion rate assumptions of 0.2 gram per day for children aged 1 year through 6 years and 0.1 gram per day for older age groups, in the absence of site specific data.

Introduction and Background:

Current Agency guidance that might be used within the OSWER programs for developing risk assessments provides ranges of different soil ingestion rates. However, no guidance is provided regarding the selection of an ingestion rate from within these ranges. In order to promote consistency within Agency guidance and the use of realistic, conservative exposure scenarios throughout the CERCLA and RCRA programs, this interim final guidance provides specified assumptions to be made for soil ingestion rates for both children and adults.

Interim Final Guidance for Soil Ingestion Rates:

This interim final guidance supersedes previous program related guidance (Superfund Public Health Evaluation Manual, October, 1986, OSWER Directive 9285.4-01) only with reference to soil ingestion rates and should be used by regional staff who are responsible for conducting and evaluating risk assessments in OSWER related programs. This interim final guidance is based on the most recent reliable data available on soil ingestion rates. It may be revised to reflect new data the Agency may review that would significantly affect risk assessment results.

In developing exposure scenarios used in program risk assessments, a soil ingestion rate of 0.1 grams per day should be used for adults and a soil ingestion rate of 0.2 grams per day should be used for children who are one year through six years of age. These rates are based on the most recent reliable data reviewed by the Agency, and represent reasonably conservative values. This guidance does not address children who exhibit abnormal mouthing behavior (pica). The occurrence of pica behavior and the associated rates of soil ingestion have not been well defined. Without this information, risk cannot be quantified for children with pica behavior.

There may be cases where site- or facility-specific data exist on soil ingestion rates or the occurrence of pica behavior of children. In these cases, deviation from this guidance may be appropriate. However, the data supporting this deviation should be provided within the related risk assessment. If the data are provided by the potentially responsible party in the Superfund program or the owner/operator in the RCRA program, these data should be reviewed and verified by the risk assessment experts in the Regions, who may also choose to consult with Headquarters.

Contacts:

If there are any general questions regarding this interim final guidance, please contact Sherry Sterling, (FTS) 382-4826, of my staff. For program specific information, the following staff may be contacted:

RCRA	Alec McBride	(FTS)382-7045
CERCLA/Fund	Dave Bennett	(FTS)475-9486
CERCLA/Enforcement	Sherry Sterling	(FTS)382-4826

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C 20460

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

SEP 7 1989

OSWER Directive #9355.4-02

MEMORANDUM

SUBJECT: Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites.

FROM: Henry L. Longest II, Director
Office of Emergency and Remedial Response

Bruce Diamond, Director
Office of Waste Programs Enforcement

TO: Directors, Waste Management Division, Regions I, II, IV, V, VII and VIII
Director, Emergency and Remedial Response Division, Region II
Directors, Hazardous Waste Management Division, Regions III and VI
Director, Toxic Waste Management Division, Region IX
Director, Hazardous Waste Division, Region X

PURPOSE

The purpose of this directive is to set forth an interim soil cleanup level for total lead, at 500 to 1000 ppm, which the Office of Emergency and Remedial Response and the Office of Waste Programs Enforcement consider protective for direct contact at residential settings. This range is to be used at both Fund-lead and Enforcement-lead CERCLA sites. Further guidance will be developed after the Agency has developed a verified Cancer Potency Factor and/or a Reference Dose for lead.

BACKGROUND

Lead is commonly found at hazardous waste sites and is a contaminant of concern at approximately one-third of the sites on the National Priorities List (NPL). Applicable or relevant and appropriate requirements (ARARs) are available to provide cleanup levels for lead in air and water but not in soil. The current

National Ambient Air Quality Standard for lead is 1.5 ug/m^3. While the existing Maximum Contaminant Level (MCL) for lead is 50 ppb, the Agency has proposed lowering the MCL for lead to 10 ppb at the tap and to 5 ppb at the treatment plant(1). A Maximum Contaminant Level Goal (MCLG) for lead of zero was proposed in 1988(2). At the present time, there are no Agency-verified toxicological values (Reference Dose and Cancer Potency Factor, ie., slope factor), that can be used to perform a risk assessment and to develop protective soil cleanup levels for lead.

Efforts are underway by the Agency to develop a Cancer Potency Factor (CPF) and Reference Dose (RfD), (or similar approach), for lead. Recently, the Science Advisory Board strongly suggested that the Human Health Assessment Group (HHAG) of the Office of Research and Development (ORD) develop a CPF for lead, which was designated by the Agency as a B2 carcinogen in 1988. The HHAG is in the process of selecting studies to derive such a level. The level and documentation package will then be sent to the Agency's Carcinogen Risk Assessment Verification Exercise (CRAVE) workgroup for verification. It is expected that the documentation package will be sent to CRAVE by the end of 1989. The Office of Emergency and Remedial Response, the Office of Waste Programs Enforcement and other Agency programs are working with ORD in conjunction with the Office of Air Quality Planning and Standards (OAQPS) to develop an RfD, (or similar approach), for lead. The Office of Research and Development and OAQPS will develop a level to protect the most sensitive populations, namely young children and pregnant women, and submit a documentation package to the Reference Dose workgroup for verification. It is anticipated that the documentation package will be available for review by the fall of 1989.

IMPLEMENTATION

The following guidance is to be implemented for remedial actions until further guidance can be developed based on an Agency verified Cancer Potency Factor and/or Reference Dose for lead.

Guidance

This guidance adopts the recommendation contained in the 1985 Centers for Disease Control (CDC) statement on childhood lead poisoning(3) and is to be followed when the current or predicted land use is residential. The CDC recommendation states that "...lead in soil and dust appears to be responsible for blood levels in children increasing above background levels when the concentration in the soil or dust exceeds 500 to 1000 ppm". Site-specific conditions may warrant the use of soil cleanup levels below the 500 ppm level or somewhat above the 1000 ppm level. The administrative record should include background documents on the toxicology of lead and information related to site-specific conditions.

The range of 500 to 1000 ppm refers to levels for total lead, as measured by protocols developed by the Superfund Contract Laboratory Program. Issues have been raised concerning the role that the bioavailability of lead in various chemical forms and particle sizes should play in assessing the health risks posed by exposure to lead in soil. At this time, the Agency has not developed a position regarding the bioavailability issue and believes that additional information is needed to develop a position. This guidance may be revised as additional information becomes available regarding the bioavailability of lead in soil.

Blood-lead testing should not be used as the sole criterion for evaluating the need for long-term remedial action at sites that do not already have an extensive, long-term blood-lead data base[1].

EFFECTIVE DATE OF THIS GUIDANCE

This interim guidance shall take effect immediately. The guidance does not require that cleanup levels already entered into Records of Decisions, prior to this date, be revised to conform with this guidance.

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[1] In one case, a biokinetic uptake model developed by the Office of Air Quality Planning and Standards was used for a site-specific risk assessment. This approach was reviewed and approved by Headquarters for use at the site, based on the adequacy of data (due to continuing CDC studies conducted over many years). These data included all children's blood-lead levels collected over a period of several years, as well as family socio-economic status, dietary conditions, conditions of homes and extensive environmental lead data, also collected over several years. This amount of data allowed the Agency to use the model without a need for extensive default values. Use of the model thus allowed a more precise calculation of the level of cleanup needed to reduce risk to children based on the amount of contamination from all other sources, and the effect of contamination levels on blood-lead levels of children.

REFERENCES

1. 53 FR 31516, August 18, 1988.
2. 53 FR 31521, August 18, 1988.
3. Preventing Lead Poisoning in Young Children, January 1985, U.S. Department of Health and Human Services, Centers for Disease Control, 99-2230.

Record of Decision ABSTRACTS

1. Marathon Battery
2. Kin-Buc Landfill
3. Celtor Chemical Works
4. Smuggler Mountain

Item 1

REGION :2
SITE NAME :MARATHON BATTERY
ROD ID :R02-86/037
ROD DATE :860930
ABSTRACT :

THE MARATHON BATTERY COMPANY (MBC) SITE, LOCATED IN THE VILLAGE OF COLD SPRING, PUTNAM COUNTY, NY, HAS TWO COMPONENTS; THE EAST FOUNDRY COVE MARSH (EFCM), AND CONSTITUTION MARSH. THE SITE BEGAN AS A BATTERY MANUFACTURING PLANT IN 1952, PRODUCING MILITARY AND COMMERCIAL BATTERIES FOR A PERIOD OF 27 YEARS. DURING THIS TIME THE SITE PROPERTY CHANGED OWNERSHIP AND ITS NAME SEVERAL TIMES. IT OPERATED AS THE MBC FROM 1968 TO 1979. APPROXIMATELY 50,000 KG OF CADMIUM WERE DISCHARGED INTO THE EFCM AS A RESULT OF MBC'S WASTEWATER TREATMENT SYSTEM. A BYPASS VALVE, USED DURING SYSTEM OVERLOADS AND SHUTDOWNS, DIVERTED FLOW TO EFCM. THIS OCCURRED AT LEAST TWICE WEEKLY FOR PERIODS OF TIME RANGING FROM A FEW HOURS TO A FULL OPERATING SHIFT. IN 1965 THE NEW YORK STATE DEPARTMENT OF HEALTH ORDERED THE PLANT TO DISCONNECT ITS INDUSTRIAL DISCHARGE FROM THE VILLAGE'S SANITARY SEWER UPON CONCLUDING THAT THE BATTERY PLANT'S PROCESS EFFLUENT COULD NOT BE MANAGED BY A NEW PROPOSED SEWAGE TREATMENT SYSTEM. ACCOMMODATING THE DIRECTIVE, THE PLANT SHUT DOWN THE DIVERSION PUMPS AND BYPASSED THE ENTIRE WASTEWATER FLOW INTO THE STORM SEWER TO EFCM. BETWEEN SEPTEMBER 1972 AND JULY 1973 HYDRAULIC DREDGING OF THE CHANNEL, WHICH CONNECTS EFCM TO CONSTITUTION MARSH, REMOVED APPROXIMATELY 90,000 SQUARE METERS OF SEDIMENT. APPROXIMATELY 4,000 CUBIC METERS OF DREDGED MATERIAL WERE THEN RETAINED IN A DIKED ENCLOSURE CONSTRUCTED OVER A PARKING LOT ON THE BATTERY FACILITY PROPERTY. DURING THE DEWATERING PROCESS, THE SEDIMENTS WERE ALLOWED TO SETTLE AND THE SUPERNATANT WAS PASSED THROUGH A STORM DRAIN AND BACK INTO FOUNDRY COVER. THE PRIMARY CONTAMINANTS OF CONCERN INCLUDE; CADMIUM, COBALT, AND NICKEL.

THE SELECTED REMEDIAL ACTION FOR THE EFCM COMPONENT OF THE SITE INCLUDES; HYDRAULIC DREDGING OF APPROXIMATELY 23,000M3 OF SEDIMENTS; SEDIMENT CHEMICAL FIXATION; OFFSITE DISPOSAL OF APPROXIMATELY 47,000M3 OF PROCESSED SEDIMENTS; DREDGING, WATER TREATMENT AND DISPOSAL; MARSH RESTORATION; AND LONG-TERM MONITORING. THE SELECTED REMEDIAL ACTION FOR CONSTITUTION MARSH INCLUDES; A NO-ACTION ALTERNATIVE WITH LONG TERM SEDIMENT AND WATER MONITORING; A PUBLIC AWARENESS PROGRAM; AND SITE ACCESS RESTRICTIONS. THE ESTIMATED CAPITAL COST FOR BOTH REMEDIAL COMPONENTS IS $16,640,000 WITH O&M COSTS OF $3,530,000 FOR THE FIRST YEAR; $180,000 FOR YEARS 2-5; AND $127,000 FOR YEARS 6-30.

REMEDY :
- PILOT PLANT TREATABILITY STUDY TO DETERMINE AN EFFECTIVE TREATMENT SCHEME FOR FIXATING THE CONTAMINATED SEDIMENTS.
- HYDRAULIC DREDGING OF THE CONTAMINATED SEDIMENTS FROM EAST FOUNDRY

COVE MARSH WITH CADMIUM CONCENTRATIONS GREATER THAN 100 MILLIGRAMS/KILOGRAM.
- THICKENING OF THE DREDGED SEDIMENTS.
- TREATMENT OF THICKENER SUPERNATANT AND DISCHARGE TO THE DREDGE CELL.
- CHEMICAL FIXATION OF THE THICKENED SEDIMENTS.
- TRUCK TRANSPORT OF THE FIXATED SEDIMENTS TO A LOCAL SANITARY LANDFILL.
- RESTORATION OF EAST FOUNDRY COVE MARSH BY ADDITION OF CLEAN FILL, CLAY WITH A HIGH AFFINITY FOR CADMIUM, AND REVEGETATION.
- DIVERSION OF THE KEMBLE AVENUE AND NEW YORK STATE DEPARTMENT OF TRANSPORTATION STORM SEWERS INTO EAST FOUNDRY COVE AND FOUNDRY BROOK, RESPECTIVELY.
- LONG-TERM MONITORING OF CONSTITUTION MARSH SEDIMENTS AND BIOTA.
- BIOASSAY SAMPLING IN EAST FOUNDRY COVE TO BETTER CHARACTERIZE THE LINK BETWEEN THE LEVELS OF CADMIUM IN THE SEDIMENTS AND BIOACCUMULATION IN AQUATIC FAUNA.
- ESTABLISHMENT OF AN INFORMATION CENTER SO THAT INTERESTED MEMBERS OF THE PUBLIC AND SCIENTIFIC COMMUNITY CAN VISIT THE SITE DURING AND AND AFTER SITE REVEGETATION.
- THIS RECORD OF DECISION (ROD) ADDRESSES ONLY THE EAST FOUNDRY COVE MARSH AND CONSTITUTION MARSH PORTION OF THE SITE. UPON COMPLETION OF THE ONGOING REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR THE WEST FOUNDRY COVE, HUDSON RIVER IN THE VICINITY OF THE COLD SPRING PIER, AND THE FORMER BATTERY FACILITY PORTION OF THE SITE, AND THE COMPLETION OF THE BIOASSAY SAMPLING IN EAST FOUNDRY COVE, A SEPARATE ROD WILL BE PREPARED.

Item 2

REGION :2
SITE NAME :MARATHON BATTERY COMPANY
ROD ID :R02-88/064
ROD DATE :880930
ABSTRACT :
THE MARATHON BATTERY COMPANY (MBC) SITE, A FORMER BATTERY MANUFACTURING PLANT, IS LOCATED IN THE VILLAGE OF COLD SPRING IN PUTNAM, NEW YORK, APPROXIMATELY 40 MILES NORTH OF NEW YORK CITY. THE AREA SURROUNDING THE SITE INCLUDES THE HUDSON RIVER TO THE WEST, RESIDENTIAL AREAS TO THE NORTHWEST, WEST, AND SOUTHWEST ADJACENT TO THE SITE, AND WETLANDS INCLUDING FOUNDRY COVE, WHICH IS DIVIDED INTO EAST FOUNDRY COVE (EFC) AND WEST FOUNDRY COVE, TO THE SOUTH. THE SITE OPERATED FROM 1952 TO 1979 PRODUCING MILITARY AND COMMERCIAL BATTERIES. DURING THIS TIME THE SITE CHANGED OWNERSHIP SEVERAL TIMES, FINALLY OPERATING AS THE MBC FROM 1969 TO 1979. BEFORE 1965, THE PLANT'S WASTEWATER TREATMENT SYSTEM DISCHARGED INTO THE HUDSON RIVER AT THE COLD SPRING PIER VIA THE COLD SPRING SEWER SYSTEM, EXCEPT DURING PERIODS OF OVERLOAD OR SYSTEM SHUTDOWN DURING WHICH TIME THE PROCESS EFFLUENT WAS DISCHARGED DIRECTLY INTO EAST FOUNDRY COVE MARSH (EFCM) TO THE SOUTHEAST. IN 1965, HOWEVER, THE PLANT BEGAN DISCHARGING ALL OF THE PROCESS EFFLUENT INTO EFCM AFTER THE NEW YORK STATE DEPARTMENT OF HEALTH CONCLUDED THAT THE INDUSTRIAL DISCHARGE COULD NOT BE MANAGED BY A NEW

Item 1

REGION :2
SITE NAME :KIN-BUC LANDFILL
ROD ID :R02-88/068
ROD DATE :880930
ABSTRACT :

THE 220-ACRE KIN-BUC LANDFILL CONSISTS OF A NUMBER OF INACTIVE INDUSTRIAL AND MUNICIPAL WASTE DISPOSAL AREAS AND IS LOCATED IN THE RARITAN RIVER 100-YEAR FLOOD PLAIN AND WITHIN A COASTAL ZONE IN EDISON TOWNSHIP, MIDDLESEX COUNTY, NEW JERSEY. BORDERING THE SITE IS AN INDUSTRIAL PARK DIRECTLY NORTH, THE EDISON TOWNSHIP MUNICIPAL LANDFILL 600 FEET TO THE SOUTH, MARSHLANDS TO THE EAST, AND THE RARITAN RIVER BORDERING THE WEST. LAND USE WITHIN ONE MILE OF THE SITE INCLUDES RESIDENTIAL, LIGHT INDUSTRIAL, AND RECREATIONAL AREAS. LANDFILL OPERATIONS WERE CONDUCTED BETWEEN 1947 AND 1977. DETAILS ON THE OWNERS/OPERATORS OF THE SIDE ARE UNKNOWN PRIOR 1968 WHEN KIN-BUC, INC. LEASED THE AREA FROM INMAR ASSOCIATES. ACCORDING TO SITE RECORDS, AN ESTIMATED 70 MILLION GALLONS OF LIQUID WASTES, INCLUDING 3 MILLION GALLONS OF OILY WASTE AND OVER 1 MILLION TONS OF SOLID WASTE, WERE DISPOSED OF BETWEEN 1973 AND 1976 ALONE. EXAMPLES OF WASTES RECEIVED INCLUDE SOLVENTS, WASTE OILS, PAINT SLUDGES, CYANIDES, METAL STRIPPING WASTES AND PAINT THINNERS. THE KIN-BUC SITE INCLUDES THREE MAJOR MOUNDS: KIN-BUC I (30 ACRES), KIN-BUC II (12 ACRES) WHICH LIES DIRECTLY NORTH OF KIN-BUC I, AND MOUND B (9 ACRES) WHICH LIES SOUTHWEST OF KIN-BUC I ADJACENT TO THE RARITAN RIVER. ADDITIONALLY, THREE PITS OF BLACK OILY LEACHATE, PITS A, B, AND C, ARE LOCATED AT THE SOUTHEASTERN EDGE OF KIN-BUC I; THERE IS A REFUSE-FILLED LOW-LYING AREA BETWEEN KIN-BUC I AND THE EDISON LANDFILL; AND AN AREA OF IMPOUNDED, TIDALLY AFFECTED WATER, POOL C, CONTAMINATED BY KIN-BUC I IS ADJACENT TO THE PITS. SITE ACTIVITIES INCLUDED BURYING AND COMPACTING CONTAINED WASTES IN KIN-BUC II, AND DISCHARGING HAZARDOUS LIQUID WASTES INTO BULLDOZED PITS AT THE TOP OF KIN-BUC I. THESE PRACTICES RESULTED IN NUMEROUS CITIZEN COMPLAINTS, CAUSED FREQUENT MAJOR ONSITE FIRES AND A NUMBER OF SERIOUS OCCUPATIONAL INJURIES. EPA BEGAN INVESTIGATIONS IN JANUARY 1976 AND DETECTED THE DISCHARGE OF HAZARDOUS SUBSTANCES FROM THE FACILITY. IN FEBRUARY 1980, EPA BEGAN CLEANUP ACTIVITIES CONSISTING OF COLLECTION, TREATMENT, AND DISPOSAL OF POOL C LEACHATE; A DRUM REDUCTION PROGRAM; OILY-PHASE LEACHATE COLLECTION AND ONSITE STORAGE; AND AQUEOUS-PHASE LEACHATE PRETREATMENT, REMOVAL, AND OFFSITE TREATMENT. IN SEPTEMBER 1980, KIN-BUC, INC. WAS ORDERED TO CAP KIN-BUC I AND II. THIS SOURCE CONTROL ROD ADDRESSES REMEDIATION OF THE FIRST OF TWO OPERABLE UNITS, WHICH INCLUDES KIN-BUC I AND II, POOL C, AND THE LOW-LYING AREA BETWEEN KIN-BUC I AND EDISON LANDFILL. A SUBSEQUENT ROD WILL ADDRESS OFFSITE MIGRATION CONTROLS. THE PRIMARY CONTAMINANTS OF CONCERN AFFECTING THE GROUND WATER, SURFACE WATER, SEDIMENTS, SOIL AND AIR ARE: VOCS INCLUDING BENZENE AND TOLUENE, OTHER ORGANICS INCLUDING PAHS AND PCBS,

AND METALS INCLUDING ARSENIC AND LEAD.

THE SELECTED REMEDIAL ACTION FOR THIS SITE INCLUDES: INSTALLATION OF A SLURRY WALL SURROUNDING THE SITE; RCRA CAPPING OVER KIN-BUC II, A PORTION OF THE LOW-LYING AREA BETWEEN KIN-BUC I AND THE EDISON LANDFILL, AND POOL C; MAINTENANCE AND UPGRADING, IF NECESSARY, OF THE KIN-BUC I CAP; COLLECTION OF APPROXIMATELY 3 MILLION GALLONS OF OILY-PHASE LEACHATE WITH OFFSITE INCINERATION AND RESIDUAL DISPOSAL; COLLECTION AND ONSITE BIOLOGICAL OR CARBON TREATMENT OF AQUEOUS-PHASE LEACHATE AND CONTAMINATED GROUND WATER WITH DISCHARGE EITHER TO SURFACE WATER OR POTW, AND DEWATERING OF RESIDUAL SLUDGES AND OFFSITE DISPOSAL; GROUND WATER MONITORING; AND O&M. THE ESTIMATED PRESENT WORTH COST FOR THIS REMEDIAL ACTION IS BETWEEN $16,290,000 AND $16,635,000 WITH ANNUAL O&M VARYING FROM $848,000 (YEAR 1) TO $405,000 (YEARS 12-20).

REMEDY :

THIS OPERABLE UNIT WAS DEVELOPED TO PROTECT PUBLIC HEALTH AND THE ENVIRONMENT BY CONTROLLING THE MAJOR SOURCES OF CONTAMINATION AS WELL AS TREATING LEACHATE AND CONTAMINATED GROUNDWATER TO THE MAXIMUM EXTENT PRACTICABLE. THE OPERABLE UNIT IS FULLY CONSISTENT WITH ALL PLANNED FUTURE SITE ACTIVITIES. FUTURE SITE ACTIVITIES INCLUDE FURTHER EVALUATION OF POTENTIAL AREAS OF CONTAMINATION AND DEVELOPING MEASURES TO MANAGE MIGRATION OF CONTAMINANTS AS WELL AS THE OVERALL SITE REMEDY. THE SELECTED REMEDY FOR THE KIN-BUC LANDFILL - OPERABLE UNIT I CONSISTS OF THE FOLLOWING COMPONENTS;

* CIRCUMFERENTIAL SLURRY WALL INSTALLATION TO BEDROCK ON ALL OF THE SIDES OF THE SITE;
* MAINTENANCE, AND UPGRADING IF NECESSARY, OF THE KIN-BUC I CAP AND INSTALLATION OF A CAP IN ACCORDANCE WITH RCRA SUBTITLE C AND STATE REQUIREMENTS ON KIN-BUC II, PORTIONS OF THE LOW-LYING AREA BETWEEN KIN-BUC I AND THE EDISON LANDFILL AND POOL C;
* COLLECTION AND OFF-SITE INCINERATION OF OILY PHASE LEACHATE;
* COLLECTION AND ON-SITE TREATMENT OF AQUEOUS PHASE LEACHATE AND CONTAMINATED GROUNDWATER WITH DISPOSAL VIA DIRECT SURFACE WATER DISCHARGE;
* PERIODIC MONITORING AND
* OPERATION AND MAINTENANCE.

ALTERNATIVELY, PRE-TREATMENT OF AQUEOUS PHASE LEACHATE AND CONTAMINATED GROUNDWATER AND DISCHARGE TO THE MIDDLESEX COUNTY UTILITIES AUTHORITY (MCUA) PUBLICALLY OWNED TREATMENT WORKS (POTW) (VERSUS TREATMENT AND DIRECT SURFACE WATER DISCHARGE) IS AN ACCEPTABLE OPTION SHOULD APPROVAL TO DISCHARGE TO THE POTW BE GRANTED BY THE MCUA.

Order number 890919-111011-ROD -003-001
page 1 set 26 with 2 of 2 items

Item 1

REGION :9
SITE NAME :CELTOR CHEMICAL WORKS
ROD ID :R09-85/009
ROD DATE :850930
ABSTRACT :
THE CELTOR CHEMICAL WORKS SITE CONSISTS OF APPROXIMATELY 2.5 ACRES, AND IS LOCATED IN THE NORTHERN END OF THE HOOPA VALLEY IN HUMBOLDT COUNTY, CA. THE HOOPA VALLEY INDIAN TRIBE IS THE OWNER OF THE CELTOR SITE. THE TRIBE LEASED THE LAND IN 1958 TO THE CELTOR CHEMICAL CORPORATION WHICH PROCESSED SULFIDE ORE FOR COPPER, ZINC, AND PRECIOUS METAL EXTRACTION. IN JUNE 1962, THE COMPANY WAS DELINQUENT IN ITS ROYALTY PAYMENTS TO THE HOOPA VALLEY INDIAN TRIBE AND AS A RESULT, ABANDONED THE SITE. MINE TAILINGS GENERATED FROM THE MILLING OPERATIONS WERE LEFT ONSITE. THESE TAILINGS, ALONG WITH NONSPECIFIC RELEASES OF PROCESSED ORE, ARE BELIEVED TO BE THE CAUSE OF THE ACIDIC SURFACE WATER RUNOFF AND ELEVATED METALS CONCENTRATIONS IN THE SOILS THROUGHOUT THE SITE. IN ADDITION, THE TAILINGS MAY HAVE CAUSED THE NUMEROUS FISH KILLS FOR WHICH THE CALIFORNIA DEPARTMENT OF FISH AND GAME CITED THE CELTOR CHEMICAL CORPORATION.
INITIAL REMEDIAL ACTIONS WERE IMPLEMENTED AT THE SITE IN OCTOBER 1983, AND INCLUDED EXCAVATION AND OFFSITE DISPOSAL OF ALL VISIBLY CONTAMINATED MATERIAL. THIS MATERIAL INCLUDED ALL TAILINGS, NON-CONCRETE STRUCTURES, AND A PORTION OF THE PASTURE ADJACENT TO THE SITE. THE SELECTED ALTERNATIVE FOR THE SECOND REMEDIAL ACTION INCLUDES EXCAVATION AND OFFSITE DISPOSAL OF ALL SOILS CONTAMINATED ABOVE SITE-SPECIFIC ACTION LEVELS AT A RCRA-APPROVED HAZARDOUS WASTE DISPOSAL FACILITY. ACTION LEVELS FOR CONTAMINANTS IN SOIL WERE BASED PRIMARILY ON THE ACCEPTABLE RANGE OF CONTAMINANT LEVELS IN SOIL AS DERIVED FROM THE EPA NATIONAL AMBIENT WATER QUALITY CRITERIA. THESE SITE-SPECIFIC ACTION LEVELS ARE; ARSENIC 100 MG/KG; CADMIUM 25 MG/KG; COPPER 2,500 MG/KG; LEAD 500 MG/KG; AND ZINC 5,000 MG/KG. TOTAL CAPITAL COST IS ESTIMATED TO BE $3,065,338 AND O&M COSTS ARE ESTIMATED TO BE $7,000 FOR AN INITIAL ONE YEAR PERIOD OF GROUNDS MAINTENANCE.
REMEDY :
- EXCAVATION AND OFF-SITE DISPOSAL OF ALL SOILS CONTAMINATED ABOVE SITE-SPECIFIC ACTION LEVELS AT A RCRA-APPROVED HAZARDOUS WASTE DISPOSAL FACILITY.

Item 2

REGION :9
SITE NAME :CELTOR CHEMICAL WORKS
ROD ID :R09-83/001
ROD DATE :831004
ABSTRACT :

THE CELTOR CHEMICAL WORKS SITE IS APPROXIMATELY 2.5 ACRES LOCATED AT THE NORTH END OF THE HOOPA VALLEY INDIAN RESERVATION IN HUMBOLDT COUNTY, CA. THE SITE WAS OPERATED AS A SULFIDE ORE PROCESSING PLANT FROM 1957 TO 1962. THE SITE WAS ABANDONED IN 1962 FOLLOWING CALIFORNIA DEPARTMENT OF FISH AND GAME CITATIONS FOR POLLUTION AND FISH KILLS IN THE NEARBY TRINITY RIVER. THE MOST ACUTE PROBLEMS AT THE SITE ARE THE EXTREMELY ACIDIC NATURE OF THE RUNOFF AND THE HIGH CONCENTRATIONS OF HEAVY METALS IN THE SOIL. THE SELECTED INITIAL REMEDIAL ACTION FOR THE SITE INCLUDES EXCAVATION, TRANSPORT, AND OFF-SITE DISPOSAL OF HAZARDOUS SUBSTANCES. OFF-SITE DISPOSAL IS ESTIMATED TO COST $340,000.

REMEDY :

Item 1

REGION :8
SITE NAME :SMUGGLER MOUNTAIN
ROD ID :R08-86/005
ROD DATE :860926
ABSTRACT :

THE SMUGGLER MOUNTAIN SITE IS LOCATED IMMEDIATELY NORTHEAST OF THE CITY OF ASPEN IN PITKIN COUNTY, CO. IT COMPRISES 110 ACRES OF WASTE ROCK, TAILINGS, AND SLAG CONTAINING HIGH LEVELS OF LEAD AND CADMIUM. THE SITE IS IN CLOSE PROXIMITY OF ASPEN, CO WHICH HAS A YEAR-ROUND POPULATION OF 4,500. IN MANY CASES, DEVELOPMENT IN THE ASPEN AREA HAS TAKEN PLACE DIRECTLY OVER WASTE PILES, OR WASTE PILES HAVE BEEN MOVED TO THE SIDES OF DEVELOPED AREAS AND REMAIN AS BERMS OR MOUNDS OF CONTAMINATED SOIL. PORTIONS OF CONTAMINATED SOIL HAVE ALSO BEEN USED FOR FILL IN SOME AREAS. THE CITY OF ASPEN OBTAINS DRINKING WATER FROM SURFACE WATERS IN THE AREA. THE ROARING FORKE RIVER PASSES THE SITE APPROXIMATELY 1,000 FEET DOWNGRADIENT TO THE SOUTHWEST, AND IS THE NEAREST SURFACE WATER. THE MINING WASTES WHICH CHARACTERIZE THE SITE ARE THE RESULT OF YEARS OF EXTENSIVE MINING, MILLING AND SMELTING OPERATIONS. AS A RESULT, WASTES ARE HIGHLY DISPERSED, AND LITTLE IS KNOWN ABOUT THEIR DISPOSITION. SOIL IS THE PRIMARY CONTAMINATED MEDIUM; HOWEVER, CONTAMINANTS HAVE BEEN DETECTED IN SOME GROUND AND SURFACE WATERS.

THE SELECTED REMEDIAL ACTION FOR THE SITE IS BROKEN INTO TWO DISTINCT OPERABLE UNITS. OPERABLE UNIT 1 - EXCAVATION AND PERMANENT ONSITE DISPOSAL OF SOILS WITH LEAD ABOVE 5,000 PPM, INCLUDING A RCRA MULTI-LAYER CAP; SOIL CAPPING OF ALL AREAS WITH LEAD BETWEEN 1,000 AND 5,000 PPM LEAD; FIVE-YEAR GROUND WATER MONITORING; AND PROVISION OF A PERMANENT ALTERNATE WATER SUPPLY FOR 5-7 RESIDENCES. OPERABLE UNIT 2 - SUPPLEMENTAL RI/FS, WITH POSSIBLE GROUND WATER REMEDIATION AND MINE RECLAMATION ACTIVITIES. ESTIMATED CAPITAL COST OF THE REMEDY IS $1,816,550 WITH ANNUAL O&M COSTS OF $30,900.

REMEDY :

I HAVE CAREFULLY REVIEWED AND CONSIDERED ALL THE INFORMATION, THE ALTERNATIVES ANALYSIS, AND THE PUBLIC COMMENTS PERTAINING TO THE SELECTION OF A REMEDY FOR THE SMUGGLER MOUNTAIN SITE. BASED ON MY REVIEW, I HAVE DETERMINED THAT THE FOLLOWING ACTIONS AT THE SMUGGLER MOUNTAIN SITE WILL EFFECTIVELY MITIGATE AND MINIMIZE DAMAGE TO AND PROVIDE ACCEPTABLE PROTECTION OF THE PUBLIC HEALTH, WELFARE, AND THE ENVIRONMENT. THIS DETERMINATION IS MADE BY THE REGIONAL ADMINISTRATOR OF REGION VIII CONSISTENT WITH THE DELEGATION OF AUTHORITY FOR REMEDY SELECTION DATED MAY 6, 1986.

THE SELECTED ALTERNATIVE IS SEPARATED INTO TWO OPERABLE UNITS. THE FIRST OPERABLE UNIT ADDRESSES THE SMUGGLER SITE AND DOES NOT INCLUDE THE RECLAMATION OF THE ACTUAL SMUGGLER MINE PORTION OF THE SITE. A SECOND OPERABLE UNIT WILL ADDRESS THE MINE RECLAMATION WORK AND WILL

CONSIDER GROUND- AND SURFACE-WATER RESPONSE ACTIONS IF THE RESULTS OF GROUND WATER MONITORING DURING THE FIRST OPERABLE UNIT INDICATE THAT SUCH ACTIONS ARE APPROPRIATE.

OPERABLE UNIT 1 - SITE REMEDY:

A. SOURCE ISOLATION OF HIGH-LEVEL WASTES.
CREATE AN ON-SITE REPOSITORY ON COUNTY-OWNED PROPERTY TO PERMANENTLY DISPOSE OF THE HIGH-LEVEL WASTES (OVER 5,000 PPM LEAD) EXCAVATED FROM THE SITE. THE REPOSITORY WILL BE UNDER THE PERPETUAL CARE OF A PERMANENT ENTITY, PITKIN COUNTY, TO ASSURE THE PERMANENT DISPOSITION OF THE CONTAMINANTS. CONSOLIDATE ALL-HIGH LEVEL WASTES FROM THE SITE (EXCLUDING THE MINE SITE) IN THE REPOSITORY. CAP THE REPOSITORY WITH A MULTI-LAYER, STABLE CAP THAT MEETS RCRA PERFORMANCE STANDARDS FOR IN-PLACE CLOSURE (40 CFR PART 264, SUBPART N).

B. SOURCE ISOLATION OF LOW-LEVEL WASTES.
ISOLATE ALL LOW-LEVEL WASTES (DEFINED AS AREAS WITH SOIL LEAD CONCENTRATIONS OF BETWEEN 1,000 AND 5,000 PPM LEAD) BY CAPPING IN PLACE WITH 6-12 INCHES OF CLEAN TOPSOIL AND REVEGETATING.

C. INCREASE GROUND-WATER MONITORING.
MONITOR GROUND WATER QUARTERLY ON-SITE FOR A PERIOD OF FIVE (5) YEARS TO DETERMINE EFFICACY OF THE CAPS IN ENHANCING GROUND-WATER QUALITY. QUARTERLY REPORTS TO EPA WILL DESCRIBE THE RESULTS OF MONITORING AND NOTE ANY TRENDS OBSERVED. MONITORING RESULTS AND REPORTS WILL BE USED TO DETERMINE IF FURTHER RESPONSE ACTIONS ARE REQUIRED.

D. ALTERNATE WATER SUPPLY.
PROVIDE A PERMANENT, ALTERNATE, WATER SUPPLY BY CLOSING GROUND-WATER WELLS FOR 5-7 RESIDENCES AND CONNECTING THE RESIDENCES TO THE EXISTING PUBLIC WATER SUPPLY.

E. OPERATION AND MAINTENANCE OF LOW- AND HIGH-LEVEL-WASTE CAPS.
PERIODICALLY INSPECT CAPS TO NOTE AND REPAIR ANY DETERIORATION, DISTURBANCE, OR DISCONTINUITY TO PREVENT CAP FAILURE. WEEKLY INSPECTIONS ARE ANTICIPATED DURING THE FIRST YEAR. BI-MONTHLY INSPECTIONS WILL TAKE PLACE FOR THE SECOND YEAR. AFTER TWO YEARS, INSPECTIONS WILL BE CONDUCTED MONTHLY. FROM THE BEGINNING OF THE FOURTH YEAR, QUARTERLY INSPECTIONS WILL BE CONDUCTED FOR THE NEXT TWENTY-SIX YEARS.

OPERABLE UNIT 2 - MINE RECLAMATION AND POSSIBLE GROUND-WATER CORRECTIVE ACTION:

A. ADDENDUM TO REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS).
AN ADDENDUM TO THE EXISTING RI/FS WILL BE PREPARED TO CHARACTERIZE THE NATURE AND EXTENT OF CONTAMINATION AND DETERMINE THE APPROPRIATE EXTENT OF REMEDY AT THE SMUGGLER-DURANT MINE SITE. THIS ADDENDUM WILL BE PREPARED IN ACCORDANCE WITH THE NATIONAL CONTINGENCY PLAN. THE SMUGGLER MINE RI/FS WILL BE SUBJECT TO PUBLIC COMMENT PRIOR TO SELECTION OF A REMEDY.

B. POSSIBLE GROUND-WATER CORRECTIVE ACTION.
CURRENT WATER QUALITY DATA DO NOT JUSTIFY ACTION, AND GROUND-WATER CONDITIONS ARE EXPECTED TO IMPROVE AFTER OPERABLE UNIT ONE IS IMPLEMENTED. HOWEVER, GROUND-WATER MONITORING RESULTS FROM THE

FIRST OPERABLE UNIT WILL BE USED TO DETERMINE IF GROUND-WATER RESPONSE ACTIONS NEED TO BE IMPLEMENTED. THIS DETERMINATION WILL BE MADE IN A SUBSEQUENT DECISION DOCUMENT.

C. PERFORMANCE OF REMEDY.

PERFORM REMEDY AS APPROVED BY EPA IN A SUBSEQUENT DECISION DOCUMENT. SUCH REMEDY WILL INCLUDE RECLAMATION OF THE MINE SITE AND, IF DETERMINED TO BE NECESSARY, GROUND-WATER CORRECTIVE ACTION.

September 9, 1988

Toxicologist, OHA, ERB
Emergency Response Branch, Office of Health Assessment

Health Consultation: Soil Cadmium Levels in Vegetable Gardens Associated with Adverse Human Health Effects, Marathon Battery Site, Putnam County, New York

Mr. William Nelson
Ms. Denise Johnson
Public Health Advisor
EPA Region II
New York, New York
Through: Chief, Emergency Response Branch, OHA

BACKGROUND

The former Marathon Battery facility is located in Cold Springs, Putnam County, New York, and previously operated as a manufacturer of nickel-cadmium batteries. Since 1981, the property has been used as a book distribution storage facility. A Health Assessment was released by ATSDR on July 16, 1987. The site is approximately eleven acres with restricted access. Twenty-nine single family homes are within 100 feet of the site perimeter, and cadmium has migrated off-site into residential yards. The Environmental Protection Agency (EPA) has requested that The Agency for Toxic Substances and Disease Registry (ATSDR) evaluate the public health concerns from exposure to cadmium (Cd) in residential gardens. A site visit was performed by Ms. Denise Johnson and Dr. David Mellard on August 25, 1988. In the Health Assessment by ATSDR and in previous health consultations with Dr. David Mellard, ATSDR has requested that additional residential soil samples be collected to better characterize off-site levels of Cd in residential soil. Because these samples were not performed, this consultation must assume that the limited residential soil data to date characterizes conditions in the residential areas. This assumption may or may not be valid.

DISCUSSION

Residential soil levels of Cd range from non-detectable to 67 ppm with most values below 24 ppm. Cd is known to bioaccumulate in plants to various degrees; therefore, concern for potential human health effects has been expressed for consumers of garden vegetables grown in cadmium-contaminated soil. At renal cortex levels between 200-400 ug/g, damage to renal tubules results in proteinuria and glucosuria. An age-adjusted increased excretion in the urine of beta$_2$-microglobulin (B_2-MB) can serve as subclinical evidence of renal tubular damage. Small increases in urine B_2-MB are not considered a severe health impact, but rather a biochemical sign that continued cadmium exposure could lead to more severe health problems. Typical U.S. concentrations of cadmium in the kidney cortex are between 20-35 ug/g with smokers having almost twice the level of non-smokers. Cadmium toxicity was brought to

the forefront in recognizing the causal association between the consumption of cadmium contaminated rice and drinking water and the Japanese disease Itai-Itai. Most individuals affected were women above the age of 40 years who had born several children, although more recent studies have detected biochemical effects in adult males. Dietary Cd intake in these women has been estimated at 300-600 ug/day (Friberg, 1971). The factors believed to have contributed to the susceptibility of this subpopulation are listed below:

1. a diet relatively low in calcium and fat-soluble vitamins, such as vitamin D,
2. the loss of bone minerals during pregnancy and lactation,
3. increased Cd absorption because of iron deficiency and lactation, and
4. trace mineral imbalances.

The World Health Organization has estimated that an intake of 200 ug/day of cadmium over a 50-year period could produce subclinical kidney damage in the most sensitive individual and has recommended a maximum acceptable daily intake of 70 ug/day. The EPA has recently reported in the July 1988, Superfund Public Health Evaluation manual, a value of 70 ug Cd/day as an acceptable chronic intake in food. While WHO's 200 ug/g Cd in the kidney cortex has been generally accepted as the threshold level for concern, other investigators have evidence that the critical concentration of Cd in kidney cortex is higher (Roels, 200-250 ug/g, humans; Nomiyama, 380-470 ug/g, monkeys; and Cole, 300-400 ug/g humans)(Ellis, 1981; and Cole, 1983). In contrast, Kjellstrom (Friberg, 1985), in a review of several human and animal studies concludes that 10% of people with an average Cd renal cortex concentration of 200 ug/g could develop renal tubular damage with low molecular weight proteinuria.

The question has been raised as to what levels in residential garden soil will lead to plant residue concentrations that can cause kidney problems. Two plant categories are present in evaluating cadmium sorption. Lettuce, cabbage, spinach, kale and other such leafy type vegetables are considered high accumulators of Cd. Typical concentrations range from 5-10 ppm (dry weight) in these vegetables when grown in soil containing 70 ppm cadmium (Davis, 1984). At soil concentrations of 15 ppm, Smilde et. al. (1982), find levels of 3 ppm (dry weight) in carrot and potato leaves and 9 and 5 ppm (dry weight) in radish and lettuce leaves, respectively. A non-linear relationship is shown to exist between soil Cd levels of 5 to 16 ppm and the green leafy portions of radish, lettuce, carrot and potato plants with higher soil concentrations of Cd leading to non-proportionally higher foliar Cd levels. Vegetable crops such as tomatoes, onions, leeks, turnips, potatoes, sweet corn, beans, beets, radishes, peas, carrots, and grains are low accumulators of cadmium. A linear relationship has been shown to exist for the root of radishes and carrots for soil levels between 5 and 16 ppm Cd (Smilde et. al., 1982). From 5 to 16 ppm soil Cd, levels typically increased 2 to 4 times in lettuce, radishes, carrots and wheat. At these same levels, potato tubers did not accumulate increased levels of Cd. Similar results were reported by Davis (1984) for soil levels between 1 and 12 ppm. Davis also found that a ten-fold increase in soil Cd levels will result in approximately a three to four fold increase in plant residue levels. Therefore, a one-to-one relationship does not exist between soil Cd levels and plant residue levels. Hence, an increase

rom 1 ppm to 10 ppm soil Cd will not result in a 10 fold increase in lant residue levels (but rather a 2 to 4 fold increase depending on the lant species). Potato tubers show less than a 2 fold increase when soil d levels increase from 1 to 10 ppm.

he typical U.S. soil concentration of Cd ranges from 0.01 to 7 ppm with a edian value of 0.5 ppm (Parr, et. al., 1983). In a survey of major U.S. rowing areas uncontaminated by human activities other than normal gricultural practices, Karen Wolnik of the Food and Drug Administration FDA) reports mean (and maximum) concentrations of Cd (ug/g wet weight) in he following vegetables: lettuce 0.026 (0.16), potatoes 0.031 (0.182), oybeans 0.059 (1.11), and sweet corn 0.0031 (0.0387). In soil containing and 12 ppm Cd, Davis found 1.2 and 2.1 ppm (dry weight) in lettuce, espectively. Since lettuce is 96% water, these values correspond to .048 and 0.08 ug/g wet weight. At 20 ppm Cd in soil, a residue level of .132 ppm wet weight is expected. In soil containing 5 and 15 ppm Cd, milde (1982) found 1.5 and 5 ppm (dry weight) in lettuce, respectively. his corresponds to approximately 0.268 ppm (wet weight) in lettuce at 20 pm Cd in soil.

In low accumulator plants, residue levels of 0.3 to 0.6 ppm (dry weight) ypically are found when soil levels range from 1 to 12 ppm. In soil ontaining 10 to 20 ppm Cd, residue levels of 0.6 to 1.0 ppm (dry weight) are expected (Davis, 1984). At 20 ppm Cd in garden soil, typical residue level in the low accumulator species would be approximately 0.04-0.1 ppm (wet weight) assuming low accumulator vegetables to range from 90 to 96% water (Davis, 1984). Table 1 depicts estimated Cd intake using the above data and FDA's 1981/82 Total Diet Study.

Table 1

	Normal Diet g vegetables consumed per day	estimated ug/g Cd plant residue (wet wt) at 20 ppm Cd soil	ug Cd/day if 50% of vegetables consumed home grown
High Accumulator Vegetables	55*	0.27	7.4
Low Accumulator Vegetables	400*	0.04-0.1	8-20
Potatoes*	159*	0.042*	6.7*
Other Foods*			16.7*
Amount Cd from commercial vegetables when 50% vegetables are home grown			2 41-53

*(Levels reported by FDA as part of 1981/82 Total Diet Study, Gartrell et. al., 1986)

The estimated dietary Cd intake when garden vegetables (grown on soil containing 20 ppm Cd) constitutes 50% of vegetable consumption ranges from 41-53 ug/day. This value is below the EPA and WHO acceptable dietary intake of 70 ug Cd/day and is far below the 200 ug/day intake necessary to lead to subclinical kidney problems in the most sensitive individual after 50 years of continuous exposure. In addition, it is unlikely that a residential vegetable garden in this neighborhood can supply the large amounts of vegetables over an extended period of time to lead to an intake level that would cause kidney problems.

Epidemiological studies have been conducted evaluating health effects associated with consumption of home grown vegetables in Cd containing soils. Large concentrations of Cd have been found in garden soils in the village of Shipham, England. Residents have been exposed since at least 1940 to soil levels ranging from 2-520 ppm with typical levels being around 90 ppm (Thornton, et. al., 1980). Comprehensive environmental assessments and health studies have been conducted addressing diet and garden vegetable consumption. In a dietary survey of Shipham residents where Cd levels in garden vegetables and vegetable consumption was monitored closely, mean dietary Cd intake was estimated to be 29-35 ug/day (Sherlock, et. al.). In a 40 year follow-up mortality study of Shipham residents, Inskip and Beral (1982) make the following statement, "Thus if cadmium contamination has any effect on the mortality pattern in Shipham it is slight and does not present a serious health hazard to the residents". The authors found a weak association with cadmium exposure and hypertensive and cerebrovascular disease. The point to remember is that potential exposure at this village was to typical Cd garden soil levels around 90 ppm with a maximum value of 520 ppm.

The area surrounding the Marathon facility is heavily vegetated, thereby reducing the potential for contaminated soil to contribute to atmospheric contamination. The degree to which the historical operation of the Marathon facility has contributed to local air pollution can not be determined, but recent air monitoring at the site could not detect elevated levels of Cd in the air.

Another potential source of Cd to local residents is through consumption of contaminated shellfish (i.e., crabs) from the Hudson River and Foundry Cove. Local and State health authorities have issued public health advisories suggesting that the public not eat more than one meal a week of crabs taken from the Hudson River.

CONCLUSION

Residential soil levels adjoining the Marathon Battery site range up to 67 ppm Cd; therefore, a potential public health threat could exist should residents consume large quantities of garden vegetables and fruits over a long period of time, which are grown in soil containing elevated levels of Cd. To determine the extent of residential soil Cd levels, additional soil analysis is required. Daily Cd intake between 300-600 ug/day for several decades has been shown to cause kidney problems thus resulting in the WHO estimation that an intake of 200 ug/day over a 50-year period may lead to subclinical kidney problems in the most sensitive individuals.

Both WHO and EPA have established an acceptable daily intake of 70 ug Cd/day. At soil Cd levels around 20 ppm, consumption of garden vegetables and fruits are unlikely to lead to kidney problems from dietary Cd intake.

RECOMMENDATIONS

. Remediate areas with potential use as residential gardens where soil Cd levels are around 20 ppm.

. Additional residential soil analysis should be conducted to determine the extent of Cd in residential soils.

. Alleviate residential fear of consuming home grown vegetables by analyzing Cd content of vegetables grown in remediated, residential soil at this site.

David N. Mellard, Ph.D.
Toxicologist

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FINAL DRAFT
FEASIBILITY STUDY REPORT
FOR
MIDWEST MANUFACTURING/NORTH FARM SITE

NORTH FARM OPERABLE UNIT

KELLOGG, IOWA

SEPTEMBER 7, 1988

WORK ASSIGNMENT NO.: 405-7LA1

DOCUMENT CONTROL NO: 395-FR1-RT-GGDN-1

REM II
WOODWARD-CLYDE CONSULTANTS
5055 Antioch Road
Overland Park, Kansas 66203

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APPENDIX

A-2 INGESTION OF VEGETABLES PATHWAY

The exposure to cadmium in vegetables grown in contaminated soil was evaluated for future residents at the site. Exposure parameters used to calculate action levels are presented in Table A-2. Action levels based on both the average and plausible maximum exposure cases are derived. Three vegetable crops were evaluated in this pathway; root, vine, and leafy crops. For the development of action levels it was assumed that all three crops are consumed in the amounts presented in Table A-2. That is, the action level corresponds to total consumption of all vegetables, not just a particular vegetable class.

The concentrations of chemicals in vegetables can be calculated by the following general formula:

$$C_{veg} = (C_s)\ (DW)\ (UF)$$

where:

C_{veg} = concentration of chemical in vegetable

C_s = concentration of chemical in soil (mg/kg)

DW = dry to wet weight conversion factor

UF = uptake factor (mg/kg vegetable divided by mg/kg soil)

Once the concentration of the chemicals of potential concern in vegetables has been estimated, they can be combined with human exposure parameters to calculate chronic daily intakes (CDIs):

#2

$$CDI = \frac{(C_{veg})\ (IR)\ (F)}{(Y)\ (ABW)}$$

where

IR = ingestion rate (kg/day)

F = frequency of exposure (days/year)

Y = total number of days in one year (365 days/year)

ABW = average body weight (70 kg)

The combination of these two equations results in a separate CDI for each vegetable class. These CDIs can then be summed resulting in a total CDI.

That is:

#3

$$CDI_T = CDI_i + CDI_{itl} \ldots CDI_n$$

where

CDI_T = total chronic daily intake of cadmium (mg/kg/day)

CDI_i = chronic daily intake for each vegetable crop i (mg/kg/day)

n = total number of vegetable crops (3, i.e. root, vine, leafy)

This set of equations, then, can be solved to calculate a soil concentration which would result in a total chronic daily intake (CDI_T) equal to the reference dose (RfD) for ingestion of cadmium:

#4

$$C_S = \frac{(RfD)\ (Y)\ (ABW)}{(F)\quad (DW_i)(UF_i)(IR_i)}$$

where:

C_s = concentration of cadmium in soil (i.e. the action level) (mg/kg)

RfD = reference dose for ingestion of cadmium (0.0005 mg/kg/day)

Y = total number of days in one year (365 days/year)

ABW = average body weight (70 kg)

F = frequency of exposure (days/year)

DW_i = dry to wet weight conversion factor of crop i

UF_i = uptake factor for crop i (mg/kg vegetable divided by mg/kg soil)

IR_i = ingestion rate of crop i (kg/day)

n = total number of vegetable crops (3, i.e. root, vine, leafy)

When solved, this equation yields action levels for cadmium concentrations in soil of 41 mg/kg and 13 mg/kg based on the average and plausible maximum exposure cases, respectively.

TABLE A-2

ASSUMPTIONS FOR ESTIMATING SOIL CADMIUM CONCENTRATION ACTION LEVELS BASED ON INGESTION OF HOMEGROWN VEGETABLES AT THE NORTH FARM OPERABLE UNIT, KELLOGG, IOWA

Parameter	Average Exposure	Maximum Exposure
Soil-Root Crop Uptake Factor[a]	0.15	0.15
Soil-Vine Crop Uptake Factor[a]	0.15	0.15
Soil-Leafy Crop Uptake Factor[a]	0.55	0.55
Root Crop Dry/Wet Weight Ratio[a]	0.22	0.22
Vine Crop Dry/Wet Weight Ratio[a]	0.059	0.059
Leafy Crop Dry/Wet Weight Ratio[a]	0.052	0.052
Root Crop Ingestion Rate[b]	0.257 kg/day	0.400 kg/day
Vine Crop Ingestion Rate[b]	0.392 kg/day	0.620 kg/day
Leafy Crop Ingestion Rate[b]	0.309 kg/day	0.500 kg/day
Frequency of Exposure[c]	15 days/year	30 days/year
Body Weight[d]	70 kg	70 kg
Cadmium Oral Reference Dose	0.0005 mg/kg/day	0.0005 mg/kg/day

[a] Based on Baes et al. (1984). Values used for root, vine and leafy crops are based on potatoes, tomatoes, and lettuce, respectively.

[b] Based on USDA (1982).

[c] Assumed values.

[d] EPA (1985).

NOTE: Refer to Appendix I of the Remedial Investigation Report for full reference citation.

Yellow

MEMORANDUM

SUBJECT: Cherokee County - Galena Subsite
Action Levels/Levels of Concern

FROM: Glenn Curtis
REMD/SPFD

TO: File

The principle contaminants of concern relative to placement of materials at the ground surface in the Galena subsite [Ground Water Surface Water Operable Unit (GW/SW OU)] have been lead and cadmium. These heavy metals have been found in the subsite soils and surface mine wastes at levels that pose a risk to the public health and environment. Efforts have been underway since the conduct of the Cherokee County Remedial Investigation (RI) to establish action levels/levels of concern for these contaminants found at the subsite. These efforts have been documented in the GW/SW OU Feasibility Study (FS) dated February 26, 1988, (1988 OUFS) and the Agency for Toxic Substances Disease Registry (ATSDR) Health Assessment for the subsite dated February 3, 1989. This memo and supporting documentation provide the basis for EPA to establish the action levels/levels of concern for both lead and cadmium at the Galena subsite.

Since the 1988 OUFS, additional information has become available regarding soil ingestion rates and lead and cadmium cleanup levels. The soil ingestion rates have been revised in a OSWER Directive # 9850.4 (attached) to 0.2 grams per day for children (0 to 6 years of age) and 0.1 grams per day for adults.

The Center for Disease Control (CDC) and subsequently the ATSDR have historically supported an action level for lead in soil between 500 to 1,000 mg/kg (ppm). This action level has been based on studies which revealed blood levels in children increasing above background levels when the concentration in soil or dust exceeds 500 to 1,000 ppm. On a case-by-case basis, the EPA has adopted a lead action level at 1,000 ppm or below for sites in a residential setting. An OSWER Directive (#9355.4-02) dated September 7, 1989, (attached) sets forth a basis for adopting soil cleanup levels for lead in soil.

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A level of concern for cadmium in soils has also been established on a case-by-case basis at other Superfund sites. Records of Decision (Smuggler Mountain - Region 8, Celtor Chemical Works - Region 9, Midwest Manufacturing/North Farm - Region 7, Marathon Battery - Region 2, Kin-Buc Landfill - Region 2 - Abstracts attached) at these sites have supported a cadmium action level in soils between 10 and 25 mg/kg (ppm). These levels have been based on unlimited access including residential uses and gardening. Discussions regarding the basis for the Marathon (Health Consultation) and Midwest Manufacturing (Feasibility Study Appendix A - Development of Health-Based Action Levels) cadmium cleanup levels are attached. Subsite-specific assumptions and calculation results which aided the establishment of cadmium cleanup levels for the Galena subsite are attached.

These reference materials supported the Agency in the decision to establish cleanup levels at the Galena subsite. The Record of Decision for the GW/SW OU provide the action levels/levels of concern for lead and cadmium applicable to the Cherokee County site - Galena subsite.

Attachments

Assumptions for Estimating Soil Cadmium Concentrations Cleanup Levels Based on Ingestion of Homegrown Vegetables at the Galena Subsite

1. All values or assumptions are the same as provided in the Midwest Manufacturing - FS Appendix A-2. These include: Average Body Weight; Cadmium Oral Reference Dose; Uptake Factors - Dry to Wet Weight Conversion Factors - and Ingestion Rate Factors for Root, Vine and Leafy Vegetables; Average and Maximum Frequency of Exposure. The following are exceptions or additional assumptions.

2. Vegetable consumption is considered incidental with some subsistence consumption.

3. Maximum cadmium concentration equals 79 mg/kg.

Calculation Results (15 day/30 day exposure)

	Cadmium Cleanup Level
3 vegetable types	3.2/1.6
2 vegetable types	37.0/18
1 vegetable type	100.0/50

REFERENCES

Mellard, David N., Sept. 1988, "Health Consultation: Soil Cadmium Levels in Vegetable Gardens Associated with adverse Human Health Effects, Marathon Battery Site, Putnam County, New York."

U.S. EPA, Sept. 1989, "Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites", OSWER Directive #9355.4-02.

U.S. EPA, Jan. 1989, "Interim Final Guidance on Soil Ingestion Dates", OSWER Directive #9850.4

U.S. EPA, Sept. 1988, "Feasibility Study Report for Midwest Manufacturing/North Farm Site North Farm Operable Unit, Kellogg, Iowa."

U.S. EPA, Feb. 1988, "Groundwater and Surface Water Operable Unit Feasibility Study, Galena subsite, Cherokee County site, Kansas."

U.S. EPA, Sept. 1986, Record of Decision - #R08-86/005, Smuggler Mountain, Aspen Colorado

U.S. EPA, Sept. 1985, Record of Decision - #R09-85/009, Celtor Chemical Works, Hoopa Valley Indian Reserve.

U.S. EPA, Sept. 1988, Record of Decision - #R02-88/064, Marathon Battery Site, Cold Spring, New York.

U.S. EPA, Sept. 1988, Record of Decision - #R02-88/068, KM-Buc Landfill, Edison New Jersey